REFINING THE MODELING OF BUFFER ZONE CONCENTRATIONS: UPDATE 2016

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Fumigated fields have a substantially different energy balance than those routinely represented in standard dispersion models that re used to support buffer zone analysis and other applications. Irrigation, compaction, bedding, the orientation of the beds, and the application of tarps modify the latent and sensible heat fluxes as compared to standard surface conditions represented by dispersion models. The greater heat conductivity and heat capacity of fumigated fields leads to the elimination of nocturnal inversions for bedded fields, which often are the limiting factors for establishing buffer zones. Moderate mixing (neutral atmospheric stability) is observed for all current tarp types tested. Unbedded and untarped fields also have conditions that cluster towards moderate atmospheric mixing, although the current data base is not sufficient to fully develop the concept at this time for unbedded and untarped applications.

This paper is an update on the initiative underway at Sullivan Environmental to refine the basis for establishing buffer zones for agricultural fumigants. The goal is to more accurately represent atmospheric dilution over applied fields. Since the presentation made at the 2015 Methyl Bromide Alternatives Outreach conference, substantial progress has been made in further developing this approach, including: (1) refining the environmental data base, (2) developing the to support EPA modeling based on PERFUM for either the AERMOD or CALPUFF dispersion models, and (3) developing a proposed research team to seek to increase the infrared radiation retention of TIF film and, thereby, further promote near-field atmospheric dilution and, thereby, lower near-field airborne concentrations. For anticipation of near-future and more long-range regulatory developments, there

are incentives to refine model treatments to ensure more realism in the exposure assessments. Such steps benefit all affected stakeholders.

Refining the Environmental data base – In response to comments from initial reviewers, we have documented the application methods and soil conditions for the studies included in our on-field atmospheric stability data base. The season and general location for the applications are described as well as soil type, percent field capacity, percent organic matter, bulk density, tarp color, and bed orientation, as available. Statistical analysis of the delta temperature data used to represent atmospheric stability are also summarized on a daytime and nighttime basis for the various studies in the data base, which includes bare ground, broadcast tarped, and bedded fields with VIF, TIF, LDPE, metalized and textured film. This level of documentation will support future regulatory review.

Modeling Approach – It has been concluded that the most practical way to provide more realistic treatments of on-field and near-field dispersion will be to develop a software utility program that would promote more realistic treatment of atmospheric dilution within PERFUM model applications. PERFUM is being modified to include the options of running either the AERMOD or CALPUFF dispersion models. The utility will refine dilution treatments in either model.

Developing a Proposed Research Team – A proposal has been developed, and is now under review, to seek a methodology and tarp material that will best promote a heat island effect and most vigorously promote atmospheric dilution during the critical nighttime periods. The research team includes expertise in atmospheric heat flux / dispersion modeling, polymer research, and an experienced commercial tarp manufacturer. If funded, this research will take a major step forward in promoting the commercialization of more environmentally friendly tarp material that ideally will provide a mitigation option to reduce near-field concentrations, and in some case to reduce buffer zones beyond strictly focusing on retention of the active ingredient(s). This paper also will address the following important issues:

- **Off-field (back-calculated) flux calculations**: nighttime versus daytime bias in calculated flux values and effect on buffer zone modeling. This is primarily an issue for the application period and for older flux studies that do not rely on on-field profiles and the IHF flux calculation method.

- **The limited compensation provided by the back-calculated method**: the compensation is only at one distance from the field, which likely is: (a) within the transition zone between on-field and off-field dilution conditions, and (b) is different from the range of buffer zones.

- **Administrative aspects of refining buffer zones**: the same matrix of model runs would be created, but would have the benefit of a utility that would promote greater realism in terms of representing atmospheric dilution.